

WHAT IS CLAIMED IS:

1. An optoelectronic device, comprising:

2 a substrate having a first doped region adjacent a first outer  
3 surface and a second doped region adjacent a second outer surface;

4 a wave guide located in said substrate and located between  
5 said first outer surface and said second outer surface; and

6 a capacitor located over one of said first outer surface or  
7 said second outer surface.

2 2. The optoelectronic device as recited in Claim 1 further  
3 including a metal layer located on one of said first outer surface  
4 or said second outer surface, said metal layer comprising a first  
5 electrode of said capacitor, a dielectric located over said first  
6 electrode and a second electrode located over said dielectric.

2 3. The optoelectronic device as recited in Claim 1 wherein  
3 said optoelectronic device is a tunable laser and said substrate  
4 further includes a gain region, a tuning region, an amplifier  
5 region and a modulator region.

2 4. The optoelectronic device as recited in Claim 3 wherein  
3 said substrate further includes a grating region.

5. The optoelectronic device as recited in Claim 3 wherein  
2 said first doped region is a p-type doped region and said gain  
3 region, said tuning region, said amplifier region and said  
4 modulator region are located in said p-type doped region and said  
5 second doped region is an n-type doped region and said capacitor is  
6 located on said second outer surface and an electrode of said  
7 capacitor is electrically coupled to said p-type doped region.

6. The optoelectronic device as recited in Claim 1 wherein  
2 said substrate comprises indium phosphide and said first doped  
3 region is a p-type doped region and said second doped region is an  
4 n-type doped region and said capacitor is located on said second  
5 outer surface.

7. The optoelectronic device as recited in Claim 1 wherein  
2 a dielectric layer of said capacitor is a silicon dioxide or a  
3 tantalum pentoxide.

8. A method of manufacturing an optoelectronic device,  
2 comprising:

3 forming a first doped region adjacent a first outer surface of  
4 a substrate;

5 forming a second doped region adjacent a second outer surface  
6 of said substrate;

7 creating a waveguide in said substrate; and

8 forming a capacitor over one of said first outer surface or  
9 said second outer surface.

9. The method as recited in Claim 8 wherein forming a  
2 capacitor includes placing a first electrode metal layer on one of  
3 said first outer surface or said second outer surface, forming a  
4 dielectric over said first electrode and forming a second electrode  
5 over said dielectric.

10. The method as recited in Claim 8 wherein said  
2 optoelectronic device is a tunable laser and said method further  
3 includes forming a gain region, a tuning region, an amplifier  
4 region and a modulator region in said substrate.

11. The method as recited in Claim 10 further including  
2 forming a grating region in said substrate.

12. The method as recited in Claim 10 wherein forming said  
2 first doped region includes forming a p-type doped region and  
3 forming said gain region, said tuning region, said amplifier region  
4 and said modulator region includes forming said gain region, said  
5 tuning region, said amplifier region and said modulator in said p-  
6 type doped region;

7 forming said second doped region includes forming an n-type  
8 doped region; and

9 forming said capacitor includes forming said capacitor on said  
10 second outer surface and includes electrically connecting an  
11 electrode of said capacitor to said p-type doped region.

13. The method as recited in Claim 8 wherein said substrate  
2 comprises indium phosphide and forming said first doped region  
3 including forming a p-type doped region and forming said second  
4 doped region includes forming an n-type doped region and forming  
5 said capacitor includes forming said capacitor on said second outer  
6 surface.

14. The method as recited in Claim 8 wherein forming said  
2 capacitor includes forming a dielectric layer comprising silicon  
3 dioxide or tantalum pentoxide.

15. An integrated optoelectronic system, comprising:

at least one optical device, including:

an optical substrate having a first doped region adjacent a first outer surface and a second doped region adjacent a second outer surface;

a wave guide located in said substrate and located between said first outer surface and said second outer surface; and

a capacitor located over one of said first outer surface or said second outer surface;

an optical fiber coupled to said at least one optical device and located on or within said semiconductor substrate; and

a detector coupled to said at least one optical device.

16. The integrated optoelectronic system as recited in Claim 15 further including a metal layer located on one of said first outer surface or said second outer surface, said metal layer comprising a first electrode of said capacitor, a dielectric located over said first electrode and a second electrode located over said dielectric.

17. The integrated optoelectronic system as recited in Claim 15 wherein said optical device is a tunable laser and said optical substrate further includes a gain region, a tuning region, an

4 amplifier region and a modulator region.

18. The integrated optoelectronic system as recited in Claim  
2 17 wherein said optical substrate further includes a grating  
3 region.

19. The integrated optoelectronic system as recited in Claim  
2 17 wherein said first doped region is a p-type doped region and  
3 said gain region, said tuning region, said amplifier region and  
4 said modulator region are located in said p-type doped region and  
5 said second doped region is an n-type doped region and said  
6 capacitor is located on said second outer surface and an electrode  
7 of said capacitor is electrically coupled to said p-type doped  
8 region.

20. The integrated optoelectronic system as recited in Claim  
2 15 wherein said optical substrate comprises indium phosphide and  
3 said first doped region is a p-type doped region and said second  
4 doped region is an n-type doped region and said capacitor is  
5 located on said second outer surface.